OFFICE OF TECHNOLOGY ASSESSMENT ■ U.S. CONGRESS

REPORT *brief*

SEPTEMBER
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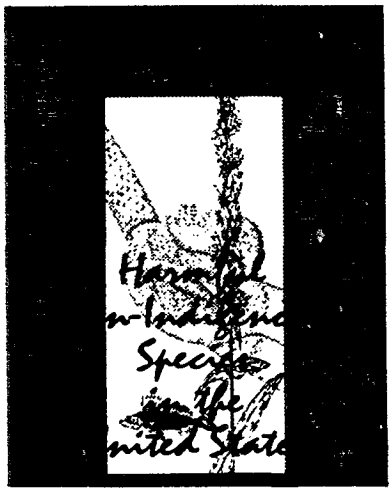
The Nation can further cut the costly effects of non-indigenous species

Harmful non-indigenous species (NIS)—those plants, animals, and microbes that are found beyond their natural geographical range—annually cost the Nation millions to billions of dollars and cause significant and growing environmental problems, says a new report from the Office of Technology Assessment, **Harmful Non-Indigenous Species in the United States.** At the same time, beneficial NIS form the backbone of American agriculture and are important in horticulture, fish and wildlife management, biological control, and the pet industry. OTA's work takes a comprehensive look at the damaging species.

WHAT'S WHERE

The movement of plants, animals, and microbes is much like biological roulette. Once in a new environment, an organism may die. Or it may take hold and reproduce with little noticeable effect. But sometimes a new species spreads, with devastating results.



Almost every part of the country faces at least one highly damaging NIS—like the zebra mussel, gypsy moth, or leafy spurge (a weed). They affect many national interests: agriculture, industry, the protection of natural areas, and human health. The melaleuca tree, for example, is rapidly degrading the Florida Everglades system by replacing sawgrass marshes, forests, and other natural habitats with single species stands. In Hawaii, NIS are responsible for extinctions and replacements of indigenous species; they now make up at least one-half of the State's wild plants and animals.

Naturally occurring movements of species into the United States are rare. Most organisms arrive with human help. Numerous NIS entered the country as unintended contaminants of commodities, packing materials, shipping containers, or ships' ballast. Others were intentionally imported as crops, ornamental plants, livestock, pets, or aquaculture species—and later escaped. For example, at least 36 of the West's 300 weeds escaped from horticulture or agriculture. A number of NIS were imported to improve soil conservation, fishing and hunting, or biological control but caused unexpected harm.

THE GOOD, THE BAD, THE "WHO KNOWS?"

Some NIS (like soybeans and most pets) are clearly beneficial; some (like gypsy moths, Russian wheat aphids, and crabgrass) are clearly harmful. Some are both, depending on location. And value is in the eye of the beholder. Purple loosestrife, for example, is an attractive garden plant and a major wetland weed.

At least 4,500 NIS of foreign origin have established free-living populations in the United States, a much larger number than were present 100 years ago. Approximately 15% of the total species trigger severe harm. Most species' economic impact is not

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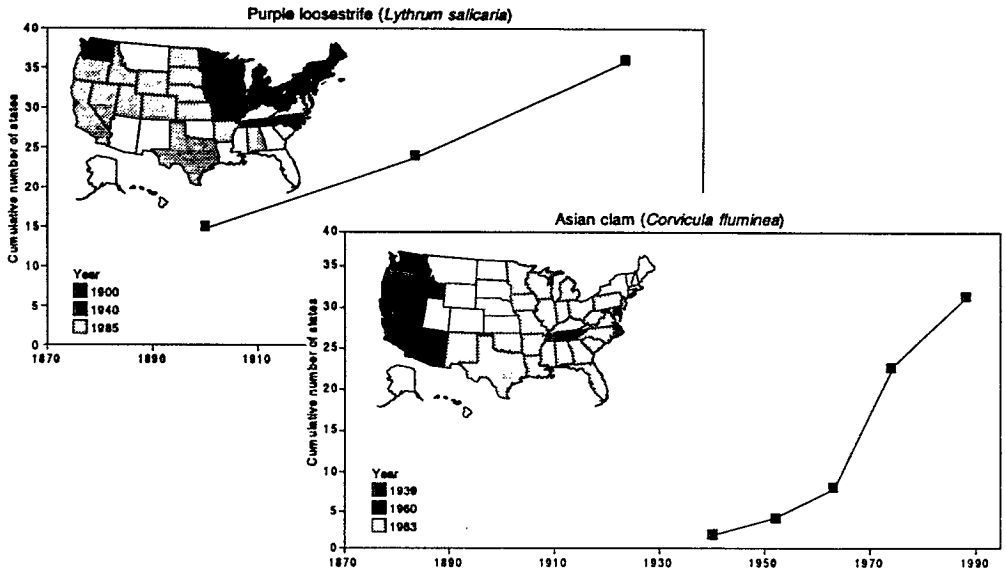
State by state spread of two harmful non-indigenous species



recorded. However, from 1906-1991, just 79 NIS caused documented losses of $97 billion, mostly in control costs and losses of marketable goods. A worst case scenario for 15 potentially high-impact NIS adds another $134 billion in future economic losses. This figure likely represents only a fraction of the total costs because many species and kinds of effects are uncounted. Harmful NIS also have exacted a significant toll on U.S. natural areas, ranging from wholesale changes in ecosystems to more subtle ecological alterations.

The rate of harmful introductions fluctuates in response to social, political, and technological factors. This rate does not appear to be increasing, although it is far higher than the natural rate of introductions. The cumulative number of foreign NIS in the United States, however, is climbing steadily and swiftly—creating an ever greater economic and environmental burden. Just since 1980, over 200 foreign species were first introduced or detected and at least 59 of these are expected to be harmful.

Uncertainty in predicting types and levels of risk remains a problem. Past intentional and accidental fish and wildlife introductions, for instance, have had about equal chances of turning out badly. Uncertainty can be reduced, or at least be made explicit, using methods such as risk analysis, benefit/cost analysis, environmental impact assessment, and decisionmaking protocols. The central issues for NIS and genetically engineered organisms, a special subset of this group, are the same: how to match an organism's potential for harm to pre-release scrutiny, how to treat high-risk species, and how to anticipate effects in new environments.

AN OUNCE OF PREVENTION?

For some species, prevention is the best strategy. However, port inspection and quarantine are fallible, with diminishing returns above a certain point. Also, some organisms are more easily controlled than intercepted. So aiming for a standard of "zero entry" is unrealistic, especially if prevention comes at

The Office of Technology Assessment is an analytical arm of the U.S. Congress. OTA's basic function is to help legislators anticipate and plan for the positive and negative effects of technological changes.

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the expense of control. When prevention fails, rapid response is essential. So far, such quick action has prevented establishment of the Asian gypsy moth, a major threat to Pacific Northwest forests. Managing non-indigenous pests presents hard choices because funds, technology, and other resources are often limited. Sometimes this means not controlling already widespread organisms, or those for which control is very expensive, or those having lower impacts.

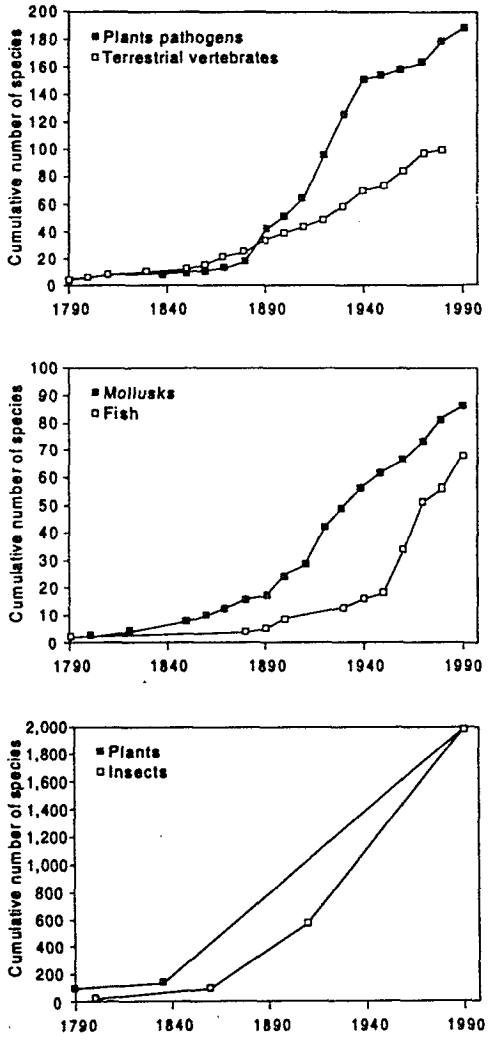
Chemical pesticides play the largest role now in containing, suppressing, or eradicating NIS and they will remain important. An increased number of biologically based technologies can be predicted. Genetic engineering will increase the efficacy of some. Those who develop biological and chemical pesticides face the same difficulties—ensuring species specificity, slowing the development of pest resistance, preventing harm to non-target organisms, clearing regulatory hurdles, and providing profits for manufacturers.

A PATCHWORK OF POLICY

The Federal Government has responded to harmful NIS with a largely uncoordinated patchwork of laws, regulations, policies and programs. Many only peripherally address NIS, while others address the more narrowly drawn problems of the past. At least 20 Federal agencies are involved, with the U.S. Departments of Agriculture and Interior playing the largest roles. Federal laws leave both obvious and subtle gaps that most States do not fill adequately. Significant gaps exist for fish, wildlife, animal diseases, weeds, species in non-agricultural areas, and vectors of human diseases. Many of these gaps also apply to genetically engineered organisms because they are commonly regulated under the same laws.

Federal agencies manage about 30% of the Nation's lands, many with grim NIS problems. Yet management policies are often inconsistent or inadequate. Even the National Park Service, with fairly strict rules, finds invasions threatening the very characteristics for which some parks were founded.

Federal and State agencies cooperate on many programs related to agricultural pests, but their policies can also conflict, e.g., when agencies manage adjacent lands. Sometimes



The cumulative numbers of non-indigenous species in the United States

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OTA REPORT *brief*

Major policy issues covered in the assessment

- A more stringent national policy
- Managing non-indigenous fish, wildlife, and other diseases
- Growing problems of non-indigenous weeds
- Damage to natural areas
- Environmental education as prevention
- Emergencies and other high priority actions
- Funding and accountability
- Gaps in legislation and regulation

Federal law preempts State law, more often regarding agriculture than fish and wildlife. Conflicts between States also occur, often without forums for resolving disputes.

State laws are relatively complete for agricultural pests but spotty for invertebrate and plant pests of nonagricultural areas. The State role is most critical for the import and release of fish and wildlife. These laws use a variety of approaches and vary from lax to exacting. While many fish and wildlife laws are weak and inadequately implemented, others present exemplary approaches. Harmful NIS have hit Hawaii and Florida particularly hard because of their distinctive geography, climate, history, and economy. Cooperative efforts have sprung up in both places. Increasingly, State and Federal agencies, nongovernmental organizations, agricultural interests, and universities see harmful NIS as a unifying threat and public education as an important tool to alleviate it.

CONGRESSIONAL CHOICES

Congress can select many ways to better protect U.S. resources. Specific actions might include amendments to the Lacey Act and the Federal Noxious Weed Act. Congress might require stricter screening for invasiveness for federally funded efforts using NIS. Congress could direct more funds to weed management on public lands and to resource management in the national parks. Congress could expand environmental education and provide Federal agencies with adequate authority for emergencies.

Imposing new responsibilities without providing money for them does not work. Entrance or user fees could fund more rigorous and scientific decisionmaking and additional control. Fines, levied on those who bring harmful NIS into the country or spread them to new States, could more closely match the real costs of publicly funded management. Federal policy cannot succeed without State help. Model State laws or national minimum standards could ensure that all States have authority to regulate harmful NIS adequately.

NIS are here to stay and many of them are welcome. Problems due to harmful ones are likely to worsen, however. Human migration and population growth, increasing trade and travel, and, possibly, climate change propel species' movements. Countervailing trends—toward stricter screening and more sophisticated control—are weaker. We can envision a future in which harmful NIS are so widespread that economic costs snowball and one place looks much like another. Or we can imagine a future in which beneficial NIS contribute much to human well-being, harmful ones are effectively limited, and indigenous species are preserved. Choosing this vision, rather than another, is ultimately a cultural and political choice—a choice about the kind of world we value and in which we want to live.

Copies of the report for congressional use are available by calling 4-9241.

Copies of the report for noncongressional use can be ordered from the Superintendent of Documents, U.S. Government Printing Office, S/N 052-003-01347-9, $21.00 each, P.O. Box 371954, Pittsburgh, PA, 15250-7954, (202) 783-3238.

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